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The Logical vs. the Ontological Understanding of Conditions

Rögnvaldur Ingthorsson

According to the truth-functional analysis of conditions, to be 'necessary for' and 'sufficient for' are converse relations. From this it follows that to be 'necessary and sufficient for' is a symmetric relation, that is, that if P is a necessary and sufficient condition for Q , then Q is a necessary and sufficient condition for P . This view is acknowledged to be contrary to common sense. In this paper I point out that it is also contrary to a widely accepted ontological view of conditions, according to which if P is a necessary and sufficient condition for Q , then Q is no sense a condition for P ; it is a mere consequence of P .

Key words: Necessary and sufficient conditions, Conditionality, Ontology, Wertheimer, Causality, Truth-functional analysis

1. Introduction

The truth-functional analysis of conditions has undeniably become the standard view of conditions even though it is known to suffer from some difficult problems, e.g. that it fails to distinguish between relevant and irrelevant conditions; *any* true statement is a necessary condition for *any* other truth. However, this paper concerns another problem, notably, that the truth-functional view depicts the relationship between conditions and their consequences as being in a certain sense symmetrical; if p is a necessary condition for q , then q is a sufficient condition for p . The truth-functional understanding of conditionals conflicts with the common sense view, say, that writing a thesis is necessary for getting a degree, but getting a degree is not sufficient for writing a thesis. The degree is a mere consequence of the writing. Getting a degree (not to be confused with the promise of getting a degree) cannot contribute to the writing, since it is only awarded on the condition that the thesis is completed.

The symmetry between the terms of conditional claims is further strengthened, on the truth-functional account, in the case of conditions that are both necessary and sufficient; the converse relationship assumed to hold between necessary and sufficient conditions entails that if p is a necessary *and* sufficient condition for q , then q is likewise a necessary and sufficient condition for p . This, again, runs counter to the common sense view that

lightning is necessary and sufficient for thunder while thunder is in no sense at all a condition for lightning. Lightning makes thunder come about, but not vice versa.

The idea that necessary and sufficient conditions are converse relations has been challenged before, e.g. by an appeal to counterexamples. The challenge rests on the observation that if the truth-functional analysis is correct, then it should always be possible to paraphrase sentences of the form “if p occurs, then q occurs” as “ p occurs only if q occurs”. One well-known counterexample is “if you touch me, I’ll scream” (McCawley 1993, p. 317). It is evident that the speaker does not imply that he will be touched only in case he screams, or indeed intend the screaming to be any kind of condition for being touched. Hence the sentence cannot be paraphrased as “you touch me only if I scream”.

I think that not only are there the occasional counterexample to the standard view, but that in ontology *every* example can arguably be portrayed as a counterexample. Like Roger Wertheimer (1968), I think it is not adequately appreciated that there exists an ontological understanding of conditionality that fits to the common sense view, and which is incompatible with the truth-functional analysis. The incompatibility between the ontological understanding and the truth-functional analysis has been largely overlooked in the discussion about conditionals, even though the ontological understanding is often implicitly assumed in ontology.

For instance, it is assumed in the issue on metaphysical necessity that it makes a difference whether necessity can be defined in terms of possible worlds or if necessity or essence defines possible worlds. Thus it is assumed that it makes a difference whether *de re* modality should be defined in terms of possible worlds in the following way,

for any entity e , e is essentially F, *iff* e is F in every world where e exists,

or if it should be the other way around,

for any entity e , e is F in every world where e exists, *iff* e is essentially F.

On the truth-functional view the two are equivalent and the dispute meaningless.

It should be mentioned that I presuppose that the truth-functional analysis is not intended to be a mere stipulation or analytic definition of conditionality, comparable to the definition of what it is to be a perfect circle (which allegedly to not obtain in reality).

It's acceptance, as a standard theory of conditionality, at least in ontology, must rest on its perceived success in correctly capturing the nature of conditionality (or at the least be perceived as the best theory available).

I should also say that I take the issue about conditionality, in ontology, to revolve around the conviction that things just don't occur in a haphazard manner; that they occur only under certain circumstances in a lawful manner. The problem has been to give an account of the relationship between the things that occur, and the different part of the circumstances that determine whether they occur or not.

2. The Truth-Functional Understanding of Conditionality and its Limits in Ontology

There is a basic understanding of conditions that I think everybody agrees upon, and which you will find in any textbook in which the notion of condition is explained. This is, firstly, that a sufficient condition is something that, if satisfied, *guarantees* that something else obtains; p is a sufficient condition for q if q obtains whenever p obtains; i.e. 'if p then q '. For instance, lightning is a sufficient condition for thunder because whenever there is lightning there is also thunder. Secondly, that a necessary condition is something that *must* be satisfied in order for something else to be true; p is a necessary condition for q if q cannot obtain without p , i.e. ' q only if p '. For instance, lightning is a necessary condition for thunder, because unless there is lightning there will not be thunder. Finally, a necessary *and* sufficient condition is something that, if satisfied, guarantees that something else obtains, and is the only thing to do that; p is a necessary and sufficient condition of q if q obtains whenever p obtains and only when q obtains; i.e. ' q if and only if p '. For instance, lightning is both necessary and sufficient for thunder, because there is always thunder when there is lightning and only then.

However, according to the truth-functional analysis, 'necessary for' and 'sufficient for' are converse relations, i.e. it depicts 'if p then q ' as equivalent to ' p only if q ', and likewise ' q only if p ' as equivalent to 'if q then p '. This entails in its turn that ' p iff q ' is equivalent with ' q iff p '. Accordingly, on the truth-functional analysis, thunder is a necessary and sufficient condition for lightning just as much as lightning is a necessary and sufficient condition for thunder.

The mutual conditionality between lightning and thunder, as depicted by the truth-functional view, doesn't comply well with either common sense or with what physics tells us about the nature of lightning, i.e. about the conditions under which lightning and thunder occur, respectively. Physically, thunder is explained as being the sound (vibrations in the air) produced by a surge of electricity between negatively and positively charged portions of humid air, i.e. thunder is explained in terms of the effects of a lightning. In other words, in order for thunder to occur, there must first occur a lightning, but thunder is not a part of the conditions that need to obtain in order for lightning to strike; thunder is a mere consequence of lightning.

As for common sense, the relation between conditions and consequences are clearly asymmetrical. An ordinary person saying 'I would have caught the bus if I had finished sooner' is talking about consequences of her actions (she missed the bus), and how things could have turned out different as a consequence of having acted otherwise (she would have caught the bus). Her claim is not equivalent to the claim that 'I had finished sooner if I would have caught the bus' as if her catching the bus could have somehow made her finish sooner. Catching the bus could not have made her finish sooner, because she would have had to finish sooner first in order to catch the bus; simply put, catching or missing the bus is a mere consequence of when she finishes her job and not a condition at all for when she finishes her job (of course, her *intention* of catching the bus could persuade her to finish sooner, but the act of actually catching the bus could not have made her finish sooner).

The important distinction here is that whereas lightning is a necessary and sufficient part of the circumstances that allow the occurrence of thunder then thunder is not a part of the circumstances that allow lightning. Obviously, this reasoning is dependent on bringing in causal considerations, in particular it is dependent on a conception of causality that is compatible with the idea that causes produce their effects, i.e. bring them into existence. But then again, that causes produce their effects is at the heart of the common sense conception of conditionality, it is about the causes that make some things come about and the circumstances that must obtain in order for the cause to be effective.

On a roughly Humean interpretation of causation, lightning and thunder are events that happen to always occur in pairs, and whose repeated observation 'produces' a

cognitive connexion between the idea of lightning and of thunder, which makes us always expect to hear thunder when we see lightning. For the sake of argument, I will happily concede that the truth-functional analysis is perfectly compatible with a consistent Humean interpretation of causality, and continue to merely argue for its incompatibility with the idea that some circumstances make possible the coming into existence of certain occurrences, while other make this coming into existence inevitable.

3. The Ontological Understanding of Conditionality

The truth-functional understanding of conditions is the received view of conditions in contemporary philosophy. However, in a certain brand of realist ontology, and in common sense, the idea of a mutual relationship between conditions and consequents is alien. The term 'necessary and sufficient condition' is there applied to a certain type of conditions, notably those that are both necessary and sufficient for the consequent, or for a conjunction of antecedents that jointly are necessary and sufficient for the consequent, but where the consequent is not a condition for the antecedent at all:

a (or $a_1, a_2...a_n$) is necessary and sufficient for the existence of b , but b is neither necessary nor sufficient for the existence of a (or $a_1, a_2...a_n$).

According to the realist view in question, ontology does not primarily deal with statements and/or propositions and their relations, but with the basic structure of the world, the nature of the kinds of entities that inhabit it, and the relationships between them.

Furthermore, it treats the truth of statements about reality as dependent on the nature of the reality these statements they are about, because it considers the truth of these statements to be a consequence of their correspondence to facts. Contingent truth, according to this view, is a property that *cannot* be possessed solely in virtue of truth-value links that hold between propositions independently of the relations of ontological determination that exist in the world. True, if 'there is thunder' is true, then 'there has been lightning' is also true, but not because the truth of 'there is thunder' itself warrants the truth of 'there has been lightning' in virtue of a truth-value link, but because as a matter of fact every thunder is produced by lightning. There is a truth-value link between

'there is lightning' and 'there is thunder', because there is a causal link between lightning and thunder.

According to the ontological view, a merely necessary condition is something, *a*, whose existence is required for it to be possible for something else, *b*, to come about. The condition *a* may itself not be enough to actually produce *b*. For a window to break when a brick hits it with a certain force *F*, it is necessary that the window is fragile (a bullet proof glass would not break). It is therefore a necessary condition for the breaking that the window is fragile, but fragility itself never breaks any windows, hence it is not sufficient.

A merely sufficient condition is something which always and invariably produces the consequent, but which may not be the only thing to do just that. A brick hitting a window with the force *F* may be sufficient for the breaking of a fragile window, and therefore invariably results in a broken window, but so can a blow by a baseball-bat and many other things as well. Hence, the hitting of a fragile window by a brick with the force *F* is not a necessary condition; it could be broken by something else. A necessary *and* sufficient condition, in ontology, is something whose occurrence *always* and invariably produces a certain consequence and is the *only* thing to do just that.

Whether there really exists anything which is both a necessary and sufficient condition is a controversial matter in ontology, and the controversy of this issue coincides with the controversy of the characterisation of causes as necessary and sufficient for their effects, i.e. it coincides with the search for a necessary connexion between cause and effect. Consequently, any suggested example of a necessary and sufficient condition will be controversial. Perhaps the least controversial example of a single occurrence that is both necessary and sufficient would be *The Big Bang*. It is, arguably, a necessary and sufficient condition for the present state of the universe. But usually we have two or more conditions that each are either merely necessary or merely sufficient, but together they are necessary and sufficient for the existence of the consequent, e.g. as suggested in Mackie's analysis of causation in terms of INUS conditions (1965).

However, despite the controversy concerning the reality of necessary and sufficient conditions, then, in ontology, consequents are never assumed to be something whose existence is required for the existence of the condition. The condition is something that must be able to obtain in some way prior to (perhaps not always temporally prior, granted

the possibility of simultaneous and backward causation) and independently of the consequent. A lightning is in no way enabled by thunder, even though it may perhaps always produce thunder. Not even backwards causation is a counterexample to this thesis. Backwards causation, if it were shown to occur, would only be a counterexample to the thesis that conditions must always precede their consequences in time, but not to the thesis that the condition is something that must be able to obtain in some way independently of the consequence.

The notion of condition and consequence, as they are used in ontology, are, I admit, to some extent intuitive, and their precise determination would require us to settle the controversy regarding a number of ontological issues, in particular causality. But I do think our intuitive understanding of them is adequate to the task of discussing the difference between necessary and sufficient conditions in the logical and ontological sense.

There is then in the notion of ontological condition the idea that the condition is existentially nondependent on the consequent, while the consequent is existentially dependent on the condition (see Bunge 1959: p. 38 & 39; Wertheimer 1968). Please note that this does not necessarily mean that the condition is *temporally* prior to the consequence, just that the existence of the condition must be made possible by something other than the consequent. It could for instance be argued that vibrations in the air are produced at the very same time as there is a surge of electricity, and yet it is the surge of electricity that produces the vibrations and not vice versa.

Also note that 'condition for' or a 'consequence of', like 'necessary for' and 'sufficient for' is relational. No contingent state of affairs is a condition without being itself a consequence of something else. However, it cannot be a consequence of the very consequence for which it is a condition. If condition and consequence are existential conditions for each other, then either both must always have existed (in which case it is not clear in which sense they are existential conditions), or neither could ever exist (because neither could come into existence to make the existence of the other possible unless the other already existed). There is a third possibility, notably that both come into existence together. But, then there must surely have been a condition *c* for the coming into existence of *a* and *b*, and if conditions are always mutual then *c* must also have come

into existence together with *a* and *b*; an infinite regress arises leading to the conclusion that everything must have come into existence together in an initial unconditioned act of creation. Again, this reasoning assumes that it makes sense to talk about entities as coming into existence, since the idea of existential conditions makes no clear sense in an eternalistic universe where everything exists in parity.

4. Conditionality and Causality

The relation between cause and effect is the paradigmatic example of a conditional relationship. The effect is for its existence dependent upon the occurrence of the cause, while the cause is not dependent for its existence upon the occurrence of the effect (however, the cause is surely dependent on some other prior condition). Paul has stomach pains because he ate too much cake, but he did not eat too much cake because he has stomach pains. The effect is a consequence of the cause, but not vice versa. Striking a ball with a tennis-racket is what makes the ball cross the net, while the crossing of the net by a ball is not what makes the ball being struck.

There is a relationship between our knowledge about conditions and knowledge about consequences, which may be taken to imply a mutual relationship between the truth of statements about conditions and consequences. We can draw inferences about the truth of statements about conditions on the basis of our knowledge about the truth of statements about consequences. That the ball crosses the net might give us reason to think it had been struck (and hence to believe that 'the ball has been struck' is true). Consequently the truth of 'the ball crosses the net' may be thought to be a condition for the truth of 'the ball has been struck', in an epistemological sense. However, that does not make the crossing of the net by the ball an ontological condition for the striking of the ball.

The Big Bang (as far as we know) is the necessary and sufficient condition for the present state of the universe, but the present state of the universe is not in any way a condition for the occurrence of the Big Bang. The Big Bang existed long before the present state of the universe came into existence. The present state of the universe (+ knowledge of the laws of nature) may be a condition for us knowing about the Big Bang (and hence to believe that 'the universe started in a Big Bang' is true), but the present state of the universe did not in any way make it possible for the Big Bang to occur. Even

if the effect is inevitable, given the cause, so that cause and effect always occur together, then it is the cause which is thought to produce the effect and not vice versa. Instead of the effect being a necessary *condition* for the cause, in those cases, it is a necessary *consequence* of the cause.

The fact that necessary and sufficient conditions have a necessary consequence, and that therefore condition and consequence always occur together, may be what invites the identification of conditional relationships with biconditionals. Consider the following description of causality: 'if *C* occurs then (and only then) *E* always and invariably follows' (Bunge 1959, p. 47). Given this description of causality, then whenever it is the case that *C*, it will also be the case that *E*, and whenever it is not the case that *C*, then it will not be the case that *E*. Hence two statements about the existence of *C* and *E* will always either be both true or both false. But this *symmetrical* truth-functional relationship between the truth-values of statements about *C* and *E* is here depicted on the ontological level as a consequence of a relationship of *asymmetric* existential dependency between *C* and *E*, a relationship whose asymmetrical nature the biconditional completely fails to capture.

Galileo Galilei, which was allegedly the first to define a cause as being the necessary and sufficient condition for its effect, wrote: "that and no other is to be called cause, at the presence of which the effect always follows, and at whose removal, the effect disappears" (cited by Bunge in (1959; p. 33). He did not say, as far as I know, that the effect is therefore a necessary condition for the cause in the sense that there has to be an effect before the cause can possibly come about, or that if the effect is removed the cause disappears.

Galileo's analysis of causality can be much weakened without losing the basic asymmetry of the relationship between conditions and consequences, e.g. as in Mackie's analysis of causation in terms of INUS conditions (1965). According to Mackie, a causal nexus is a complex of conditions, each of which are singularly insufficient but necessary for the cause, but which together constitute an unnecessary but sufficient condition for the effect. An electric spark may be a necessary condition for a fire in the attic, but insufficient in the absence of flammable material to be ignited. Together an electric spark and flammable material may be jointly sufficient for a fire, but unnecessary in the sense

that the fire could have been started by other means (e.g. by an arsonist with matchsticks). On Mackie's account as well, the effect is a consequence of the given conditions, and not in any sense a condition for the very conditions that brought it about.

Other generic relationships fall into the same mould. Parents are the condition for the existence of their children, but children are not the condition for the existence of their parents. The parents could never have met and/or never conceived of children together, or at least not conceived those particular children, and yet existed, while the children could not have been conceived by any other parents. Of course, the individuals that are here described as 'parents' would not have the relational property of being 'parents' unless they had children, but the individual people involved are not for their existence dependent on the children, and they could have become parents by producing other children than they in fact did.

There have been thinkers in the past who have argued that the causal relation is symmetric, i.e. that the effect is just as much a condition for its cause as the cause is a condition for its effects, e.g. Hegel (1873: pp. 215ff) and J.M.E. McTaggart (1915). On closer scrutiny it turns out that these thinkers are not concerned with the ontological relation between causes and effects in the physical world, but with the logical relation between the concept of 'cause' and concept of 'effect', or between the concepts of particular causes and effects, like 'parent' and 'offspring'. The relationship between the concept of 'cause' and the concept of 'effect' is mutual, according to Hegel, because an event would not be *conceived of* as a 'cause' unless it was conceived as having an effect, and vice versa (1873: p. 215).

McTaggart even argues that because it is not necessary that a person is drunk if he has been drinking (drinking does not imply drunkenness), but it is necessary that he has been drinking if he is drunk (drunkenness implies drinking), then drunkenness is really the cause to the drinking and not *vice versa* (1915). The entire explanation of course neglects entirely the physiological account of the effects of alcohol consumption, and focuses only on the relation of implication between concepts.

To focus on the contents of concepts in our everyday conceptual scheme, follows naturally from McTaggart's and Hegel's idealist philosophy, according to which there is no material world only mental content. But, if one does not accept their idealist approach,

which I certainly do not, one should at least clearly distinguish between conceptual and ontological relationships, and take into account what empirical science tells us about the nature of physical objects.

There can be, then, mutual conceptual dependencies, between concepts, e.g. between conceptual pairs like 'parent/offspring', 'cause/effect' in which case an *understanding* of one term requires an understanding of the other. To conceive of someone as being a 'parent' is impossible without conceiving of him as having 'offspring', and no one is conceived as an 'offspring' without being at the same time conceived of as having a 'parent'. There are also relations of semantic equivalence between expressions with the same propositional content, i.e. expressions that have the same truth-conditions. 'John is a bachelor' is equivalent to saying that 'John is an unmarried man'. But, ontologically speaking, the conditional relationship between living parents and their living offspring is not mutual in this way.

All in all, the idea that necessary and sufficient conditions are asymmetrically related to their consequences pervades ontology. Not just in the philosophy of causation but in the philosophy of generic relationships in general. For instance, the idea is present in the notion of *one-sided existential dependency*; the idea that some things are for their existence dependent on something, but not vice-versa. Husserl was allegedly one of the first to introduce the notion of one-sided existential dependence. Eugenie Ginsberg (1931) later attempted to further develop his account and again Kit Fine in (1995). It has been used in the construction of so-called level ontologies, e.g. by Nicolai Hartmann (1949), Mario Bunge (1973), and Ingvar Johansson (1989). E.J. Lowe, has also recently argued for the existence of such a relation (1998, chapter 6). The distinction between the logical and ontological understanding of conditionals is therefore of vital importance for most ontological matters.

5. A Final Word

It might be objected that the above may perhaps provide some reasons to reconsider the viability of the truth-functional account of conditionality, but that it does not give a clear alternative account of what a condition or a consequence is. I should then point out that I am not really suggesting that conditions should be understood in a different ontological

sense than is already presupposed in the truth-functional account. The truth-functional account presupposes, e.g. that a sufficient condition is something that, if satisfied, *guarantees* that something else obtains; 'if p then q '. This is not a logical truth, but a generalisation of an ontological thesis. Indeed, the notions 'obtains' and 'guarantees', not forgetting 'true', in light of which 'if p then q ' makes sense, are as intuitive in this context as are 'causes', 'determines', 'condition' or 'consequence'.

Likewise the truth-functional view presupposes that a necessary condition is something that *must* be satisfied in order for something else to be true; ' q only if p '. Finally, it presupposes that a necessary *and* sufficient condition is something that, if satisfied, guarantees that something else obtains, and is the only thing to do that; ' q if and only if p '.

I have no qualms with the above characterisation of conditionality, because it is perfectly in accordance with the ontology of causality and existential dependence. Indeed, I think it is derived from ontology. What I object to is the idea that that a logical truth-table analysis can then be used to tell us that, ontologically speaking, 'necessary for' and 'sufficient for' are converse relations, and that 'necessary and sufficient for' is a symmetric relation, independently of any ontological considerations.

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